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OBSERVATIONS ON THE BODY TEMPERATURE OF DRY COWS

By Max Kriss

Institute of Animal Nutrition, The Pennsylvania State College

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While a knowledge of the normal fluctuations in the body temperature of cattle is of importance to the veterinarian insofar as it may help to detect diseased conditions, it assumes special significance when metabolism experiments on cattle are made with the respiration calorimeter. By means of the latter, the heat eliminated by the animal during a certain period of time, as well as the gaseous exchange between the animal and the atmosphere that surrounds it, is measured.* But in order to determine accurately the heat production as distinguished from the heat elimination a correction must be applied for any storage or loss of heat by the animal body and failure to do so might introduce an appreciable error. For example, if at the end of an experimental period the body temperature of an animal weighing 400 kilograms differs by 1° C. from that at the beginning, it means a storage or loss of heat by the body amounting to 332 calories (assuming the specific heat of the body to be 0.83). The data on record regarding the body temperature of farm animals are unsatisfactory for the reason that the observations have not been repeated often enough under different conditions which are known to affect the temperature of man. In this investigation an attempt has been made to secure data regarding the extent and the course of the body temperature variations in cattle and to study some of the factors that might influence them. The investigation covers a period of some sixteen weeks. The animals were two dry cows used at the same time for metabolism experiments with the respiration calorimeter, in which strict control of feeding, environment, etc., is maintained. Several series of observations on the body temperature of the cows have been made with special reference to the study of the following:

(1) Variations in body temperature from about 7.30 a. m. to about 5.30 p. m., including the effect of water drunk.

(2) Thermal gradient in the body.

(3) Variations in body temperature from about 5 p. m. to about 7 p. m., including the effect of the feed.

(4) Effect of the act of defecation and of change in position.

(5) Daily variations in body temperature measured at exactly the same hour of the day.

The observations were made by means of carefully standardized clinical thermometers. During the greater part of the experiment one and the same thermometer was used, while for simultaneous readings of the rectal and vaginal temperatures a second one was used. To avoid any possible error that might be due to the use of two different thermometers, the latter were for a few days interchanged, i.e., the thermometer used one day for measuring the rectal temperature was used the following day for the vaginal and vice versa. This was further checked by using one and the same thermometer for both the rectal and vaginal temperature readings being taken one immediately after the other.

The observations on the thermal gradient were made at a depth of 4, 5, 6, and 7 inches. All other observations were made at a depth of 7 inches. The thermometers, which were originally five inches long, were accordingly lengthened by means of a piece of rubber tubing slipped a half inch or so over the upper end of the thermometer and over the string attached to the loop and stiffened by inserting inside the rubber tubing a strip of copper wire. This added portion was finally covered with adhesive plaster and a rubber ring tightly fitted at the end. This arrangement proved to be very satisfactory. The thermometer could be inserted to the desired depth and there was little danger of breaking it during the insertion. The thermometer was ordinarily allowed to stay in the rectum or vagina for about three minutes and the time and temperature recorded immediately upon its removal.

The results of the several series of observations may be summarized as follows:

(1) The rectal temperature was higher than the vaginal when measured at the same depth of 7 inches, showing an average excess of about 0.3° F. The relative values, however, varied under different conditions, but showed a trend toward parallelism.

(2) A fall in body temperature invariably followed the drinking of water. This fall varied directly with the quantity of water drunk. After the effect of the water drunk in the morning had been overcome, the temperature remained fairly constant till about 2.30 p. m. When no water was drunk the temperature was practically constant in the morning and in the afternoon till about 2.30 p. m.

(3) There was a gradual rise in temperature in the afternoon from about 2.30 p. m. to about 5.00 p. m.

(4) Eating of feed raised the body temperature slightly for about a half hour when the cows received a maintenance ration.

(5) The temperature of the rectum or vagina was decidedly higher when measured at a depth of 6 or 7 inches, than at a depth of 4 or 5 inches.

(6) There was no material difference in temperature between a depth of 6 inches and one of 7 inches, while there was a distinct difference of temperature between a depth of 4 inches and one of 6 inches, thus showing the unreliability of measurements of temperature at a depth of less than 6 inches.

(7) The standing as compared with the lying position of the animal had hardly any effect on the body temperature, but there was some indication that the temperature was slightly affected when measured shortly after the change in position had been made.

(8) There was no difference in body temperature when measured before or after defecation.

(9) Daily fluctuations in body temperature depend to a great extent on the individuality of the cow.

(10) A variation of 0.8° F. in the rectal temperature of the same animal was observed, when measured at the same hour of the day under identical conditions and outside the influence of water or feed, while under the influence of water a difference of 1.3° F. was observed at the same hour on two consecutive days.

A detailed report of the results will appear in the *Journal of Agricultural Research.*

ON THE STRUCTURE OF FINITE CONTINUOUS GROUPS WITH EXCEPTIONAL TRANSFORMATIONS

By S. D. Zeldin

Department of Mathematics, Massachusetts Institute of Technology

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Let $X_k \equiv \sum_{1}^{r+q}{}_{i}\, f_{ik}(x)\frac{\partial}{\partial X_i},$ were $k = 1, 2, \ldots, r, r+1, \ldots r+q$, be the differential symbols of a finite continuous group G of order $r+q$, and let $E_k \equiv \sum_{1}^{r+q}{}_{j} \sum_{1}^{r+q}{}_{i}\, \alpha_j C_{jki}\frac{\partial}{\partial \alpha_i}$ be the symbols of the operators of the adjoint of G. We then have

$$(X_i, X_j) = \sum_{1}^{r+q}{}_{k}\, c_{ijk}X_k$$

$$(i, j = 1, 2, \ldots r+q)$$

and $$(E_i, E_j) = \sum_{1}^{r+q}{}_{k}\, c_{ijk}E_k,$$

where the c's are the so-called structural constants. We assume that